

LAWRENCE LIVERMORE REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, May 2-6, 2011

Fingerprinting cargo ships



The Port of Savannah is the fourth largest container port in the United States.

While airline passengers are used to the scans and pat-downs by Transportation Security Administration workers, the more than 11 million cargo containers entering American ports rarely get screened at all.

And the mere size of those containers alone could carry something as bad as a dirty bomb, or other nuclear materials.

But teams of physicists, including those from the Lab, have identified new "fingerprints" of nuclear materials, such as uranium and plutonium. The fingerprints would be used in new cargo scanners to accurately and efficiently identify suspicious materials.

The new detectors will search cargo for the fingerprints using an electron accelerator, possibly coupled to lasers that produce a finely tuned gamma-ray beam, said Craig Wuest of the Global Security Principal Directorate at Livermore.

The design sounds complex, but in some ways it resembles medical scanning equipment and appears promising to pursue, he said.

To read more, go to the [Web](#).

Using the elusive to protect nuclear material



Tens of billions of the sun's elusive neutrinos, or "ghost particles," pass through an area the size of a thumbtack every second. But most of these particles zip straight through Earth without a single interaction with another bit of matter.

Neutrino detectors are traditionally big affairs, sometimes employing large vats of water or oil to boost the chance of seeing the specters.

But physicists have been working to adapt the technology to make detectors small enough to be installed inside nuclear power plants. If their prototypes are proved, such detectors could continuously monitor nuclear reactors and provide a new way to safeguard against nuclear proliferation.

The detectors in development hunt for the neutrino's antimatter sibling, the antineutrino, which shares most of its properties. Nuclear reactors are the largest manmade source of antineutrinos. A typical 1-gigawatt nuclear reactor pumps out some 100 billion billion antineutrinos per second. Because these particles pass through any shielding pretty much unimpeded, their signal can't be masked.

A joint group of physicists based at Lawrence Livermore and Sandia California laboratories, along with researchers at Atomic Energy of Canada Limited's Chalk River Laboratories, aims to capture reactor-born antineutrinos with a detector they plan to install next year at the Point Lepreau Generating Station in New Brunswick, Canada.

To read more, go to the [Web](#).

Brain waves



Lab mechanical engineer Mike King (left) and physicist Willy Moss watch a compression test of a helmet pad.

Throughout the fighting in Afghanistan, U.S. soldiers succumb to head injuries that their helmets just can't prevent. The U.S. military said last year alone, more than 11,000 active duty soldiers were diagnosed with concussions or traumatic brain injury.

But help is on the way from two Laboratory scientists who conducted a study that found that soldiers using military helmets one size larger and with thicker pads could reduce the severity of traumatic brain injury from blunt and ballistic impacts.

Lab researchers Willy Moss and Mike King found that 1/8 of an inch of additional padding could reduce blunt force by as much as 24 percent.

"A small increase in thickness can knock that acceleration down to a point where it will make very severe injuries potentially a little less severe, and very light injuries maybe not happening at all," said LLNL mechanical engineer King during a Fox News interview.

The research may apply to improvements in helmets used in football, bicycling and on the ski slopes.

To see the complete interview, go to the [Web](#).

Santer elected to National Academy of Sciences



Ben Santer

Climate scientist Ben Santer has been elected a member of the National Academy of Sciences (NAS) for his research on human-induced climate change.

Santer, an expert in the climate change research community, has worked in the Laboratory's Program for Climate Model Diagnosis and Intercomparison (PCMDI) for nearly 20 years, and is a frequent contributor to congressional hearings on the science of climate change. He credits his success to the exceptional scientists he collaborates with at LLNL.

"I never expected to receive the phone call I got," Santer said. "This is a very humbling occasion. I will do all I can to be worthy of this honor. I will continue trying to do the best science I possibly can; I will continue trying to improve our scientific understanding of the nature and causes of climate change. I will continue trying to explain climate science in plain English; to tell the public and policymakers what we know with confidence, what is still uncertain, and why they should care about what we do and what we have learned."

Santer joins a list of eight current or former Laboratory employees to be elected to the NAS. He is one of the 72 new members and 18 foreign associates elected to the National Academy of Sciences this year in recognition of their distinguished and continuing achievements in original research. The new members bring the total number of active academy members to 2,113 and the total number of foreign associates to 418.

To read more, go to the [Web](#).

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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